UTAH GEOLOGICAL SURVEY
a division of
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National Park Service
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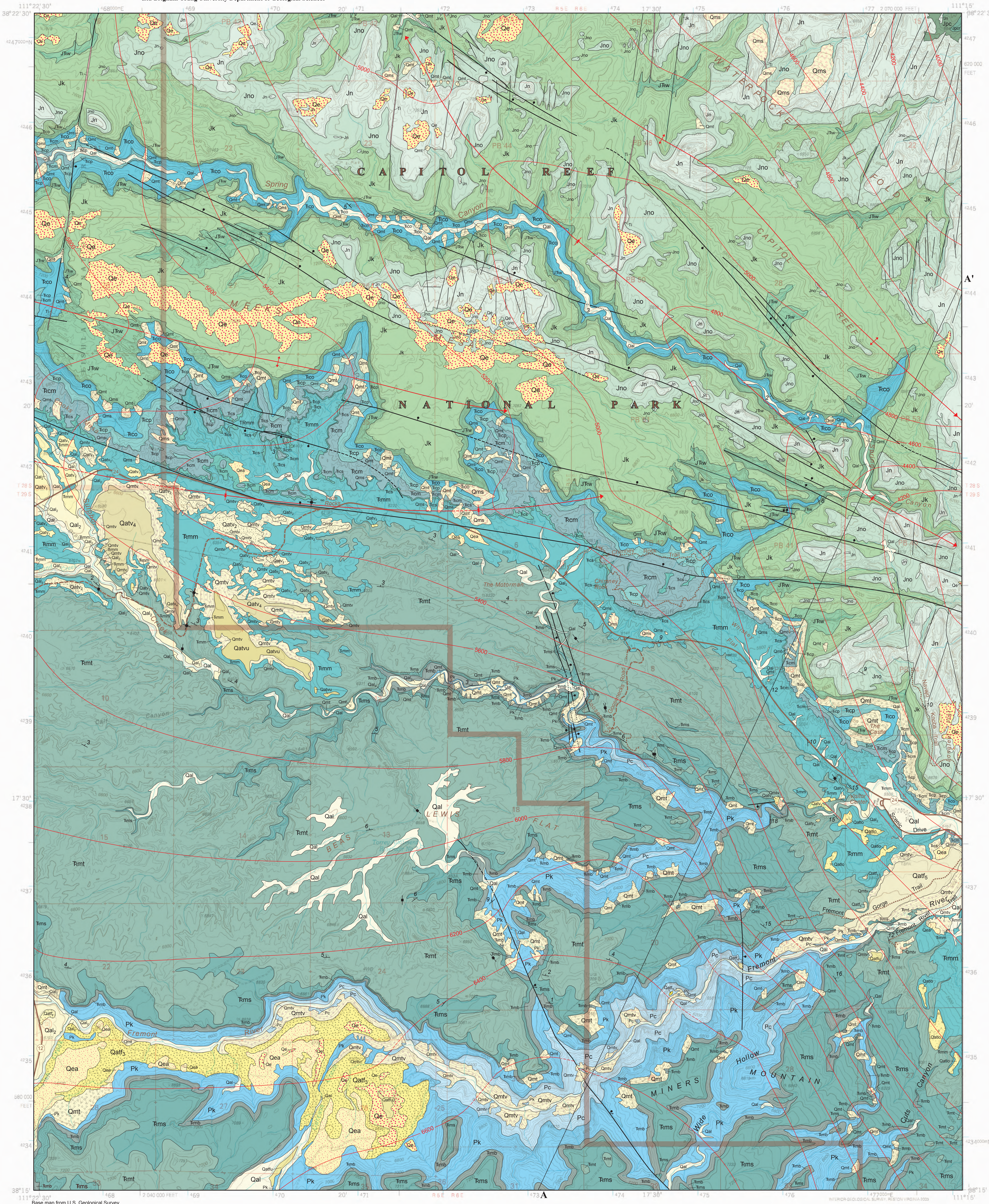

Base map from U.S. Geological Survey
Twin Rocks 7.5' quadrangle, 2001
Geologic data and base map in NAD 1927
Shaded topography generated from digital elevation data

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Utah Geological Survey, 1594 W. North Temple,
P.O. Box 146100, Salt Lake City, Utah 84114-6100.
Phone: 801-537-3300; fax 801-537-3400;
geology.utah.gov

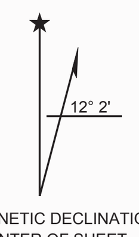
SCALE 1:24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET



2007 MAGNETIC DECLINATION
AT CENTER OF SHEET

GEOLOGIC MAP OF THE TWIN ROCKS QUADRANGLE, WAYNE COUNTY, UTAH

by

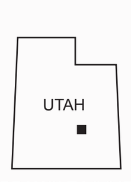
Samuel C. Sorber[1], Thomas H. Morris[2],
and Jeremy M. Gillespie[2]

2007

[1]ExxonMobil Exploration Company, Houston, Texas
[2]Brigham Young University, Department of Geological Sciences, Provo, Utah

Field mapping by authors, 2005
GIS Analyst, J. Buck Ehler
Cartographer, Lori J. Douglas
Project Manager, Grant C. Willis
ISBN 1-55791-775-2

Key access roads, selected trails, and prominent features in and near Capitol Reef National Park shown in brown. Condition and status of roads and trails may change over time. Some not shown. From data provided by National Park Service.



QUADRANGLE LOCATION

1	2	3	1 Flat Top 2 Cathedral Mountain 3 Fruita NW 4 Torrey 5 Fruita 6 Blind Lake 7 Grover 8 Golden Throne
4		5	
6	7	8	

ADJOINING 7.5' QUADRANGLE NAMES

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DESCRIPTION OF MAP UNITS

QUATERNARY DEPOSITS

Qal **Alluvial and floodplain deposits –** Poorly to moderately sorted material in modern stream and river channels. Includes clay- to boulder-size sediments composed of mudstone, siltstone, sandstone, and limestone particles. Includes low terrace deposits up to 10 feet (3 m) above the active channel. 0-10 feet (0-3 m) thick.

Qal_2 **Alluvial and floodplain deposits of a former river level –** Located 10 to 20 feet (3-6 m) above current floodplain. Clay- to boulder-size sediments composed of mudstone, siltstone, sandstone, and limestone particles. 0-20 feet (0-6 m) thick.

Qatv, $Qatv_1$, $Qatv_2$, $Qatv_3$, $Qatv_4$, $Qatv_5$, Qatvu, Qatf, $Qatf_1$, $Qatf_2$, $Qatf_3$, $Qatf_4$, $Qatf_5$, Qatfu **Volcanic boulder terrace deposits –** Sediments overlying river-cut strath terraces sourced from volcanic covered highlands to the west. Composed of pebble- to boulder-size extrusive (basaltic and andesitic) igneous rocks as well as clay- to boulder-size, locally-derived material consisting of mudstone, siltstone, sandstone, and limestone. Terraces have an easily recognized dark coloration due to the presence of weathered black volcanic boulders. 0-50 feet (0-16 m) thick terrace deposits have been divided following Eddleman (2005) according to their associated drainage and height above present stream level as follows:
Qatv - Terrace deposits associated with stream drainages other than the Fremont River. $Qatv_1$ represents deposits 0-60 feet (0-18 m) above the present stream level, $Qatv_2$ - 60-120 feet (18-37 m), $Qatv_3$ - 120-180 feet (37-55 m), $Qatv_4$ - 180-240 feet (55-73 m), $Qatv_5$ - 240-340 feet (73-104 m), Qatvu (undifferentiated) - >340 feet (104 m).
Qatf - Terrace deposits associated with the Fremont River drainage. $Qatf_1$, $Qatf_2$, $Qatf_3$, $Qatf_4$, $Qatf_5$, and Qatfu (undifferentiated) represent deposits divided in the same manner as Qatv (above).

Qatlo **Old locally derived terrace deposits –** Terraced fluvial remnants derived from local, non-volcanic sources composed of clay- to boulder-size particles of mudstone, siltstone, sandstone, and limestone. Typically very well cemented. Equivalent to Qatv4 (180-240 feet [54-76 m] above the present stream level). Located in the southeast part of the quadrangle. 5-30 feet (1.5-9 m) thick.

Qmt **Talus deposits –** Mass-movement talus deposits. Rock falls and rock slides. Composed of clay- to boulder-size particles. Commonly found where an easily erodible rock layer is located directly under a more resistant rock layer. For example, talus deposits composed of the Sinbad Member of the Moenkopi Formation overlie the Black Dragon Member in many areas, and talus deposits composed of the Wingate and Kayenta Formations overlie the Owl Creek Member of the Chinle Formation. Rarely applies to deposits over pediment-like surfaces. 0-30 feet (0-9 m) thick.

Qmtv **Volcanic boulder colluvial deposits –** Predominantly composed of talus and colluvial material weathered from volcanic boulder terraces. Includes large extrusive (basaltic to andesitic) igneous boulders as well as other locally derived material. In the Fremont River canyon the unit includes volcanic-boulder-containing material stranded along the canyon sides during ancient floods not associated with overlying, bedded terrace deposits. 0-5 feet (0-1.5 m) thick.

Qms **Landslide deposits –** Semi-coherent mass movement slump blocks and landslide deposits composed of Chinle, Moenkopi, and the lower portion of the Navajo Formations, which have slid at low angle onto underlying strata. Slide planes in Navajo slumps correspond to bedding surfaces within the red mudstone at the Kayenta-Navajo contact. While basal slide-planes are commonly seen, scarps at the head of the slump are not mappable due to subsequent erosion. 20-80 feet (6-24 m) thick.

Qe **Eolian deposits –** Very well sorted, fine-grained, well-rounded, commonly frosted, wind-blown, sand-size particles. Commonly associated with outcrops of Navajo Sandstone, but also present in other areas. 0-10 feet (0-3 m) thick.

Qea **Eolian-alluvial deposits –** Windblown, fine-grained sand to silt locally mixed with alluvial sand, gravel and clay. 0-10 feet (0-3 m) thick.

TERTIARY ROCKS

Ti **Intrusive igneous dikes –** Dark-gray trachybasalt to basanite with diabasic textures. Locally highly altered and easily eroded with poorly-defined margins. Intruded along north-south-trending near-vertical fractures in the Glen Canyon Group. 4.35±0.04 Ma ($^{40}Ar/^{39}Ar$) (Doelling and Kuehne, 2007). Referred to as shonkinite in Delaney and Gartner (1997). 2-10 feet (0.5-3 m) thick.

JURASSIC ROCKS

Jcpr **Paria River Member of the Carmel Formation** (Middle Jurassic) – Moderate-reddish-brown mudstone and siltstone, yellowish-gray siltstone, and light-gray to white gypsum. Forms ledges. 150-200 feet (45-60 m) thick.

Jpc **Page Sandstone** (Middle Jurassic) – The Page Sandstone in this area is composed of two members: the Harris Wash Member (lower), and the Thousand Pockets Member (upper), which are separated by the Judd Hollow Tongue, a member of the overlying Carmel Formation that is included in the Page map unit. The Harris Wash Member is 92 to 113 feet (28-35 m) thick. It is composed of very-pale-orange to pale-yellowish-orange, fine- to medium-grained, cross-bedded sandstone. Based on pollen assemblages and ages, the upper part of the Judd Hollow Tongue correlates with the Crystal Creek Member of the Carmel Formation as mapped in southwestern Utah, and the Judd Hollow Tongue as mapped in south-central Utah (Douglas A. Sprinkel and Hellmut H. Doelling, personal communication, 2005). It is composed of ripple-laminated, moderate-reddish-brown to dark-reddish-brown mudstone and sandstone with local interbeds of limestone. The Judd Hollow Tongue forms a slope and ranges from 10 to 17 feet (3-5 m) thick. The Thousand Pockets Member is composed of very-pale-orange to pale-yellowish-orange, fine- to medium-grained, cross-bedded sandstone with planar and contorted beds. It is 17 to 32 feet (5-9 m) thick. The Page Sandstone can be distinguished from the underlying Navajo Sandstone by the abrupt change in weathering styles. The lower portion of the Page Sandstone forms sheer cliffs above the rounded expression of the Navajo Sandstone. Map unit is 130-150 feet (40-45 m) thick.

Navajo Sandstone (Lower Jurassic) – Mapped as upper and basal members, divided by a locally continuous, thin (5-10 feet [2-3 m]), reddish-brown to reddish-orange slope-forming mudstone.

Jn **Upper member** – Very-pale-orange to pale-gray, large-scale cross-bedded, very fine to fine-grained sandstone. Localized soft-sediment deformation observable in the top 200 feet (60 m). Forms cliffs and rounded domes. Base is marked by sharp contact with underlying mudstone in the basal member. 450-550 feet (135-170 m) thick.

Jno **Basal member –** Same as upper member, except contact with underlying Kayenta Formation is gradational. Includes the mudstone that separates basal from upper member. Forms prominent cliffs at the base. Represents tongue of Navajo Sandstone into upper part of Kayenta Formation. 110-150 feet (35-45 m) thick.

Jk **Kayenta Formation** (Lower Jurassic) – Moderate-reddish-brown to moderate-reddish-orange, irregularly bedded sandstone, siltstone, and mudstone. Forms stepped topography composed of ledges (local cliffs) and slopes. Upper 50-80 feet (15-25 m) locally contains blocky, cliff-forming, very fine to fine-grained, cross-bedded sandstone. 200-300 feet (60-90 m) thick.

JURASSIC - TRIASSIC ROCKS

J$\overline{T}$rw **Wingate Sandstone** (Lower Jurassic to Triassic[?]) – Light-brown to moderate-reddish-brown, cross-bedded to massive, very fine to fine-grained, calcite-cemented sandstone. Forms the sheer cliffs of the western escarpment of the Waterpocket Fold. Cliff faces are commonly highly fractured and covered with black to brown desert varnish. 260-310 feet (80-95 m) thick.

TRIASSIC ROCKS

$\overline{T}$rco **Owl Rock Member of the Chinle Formation** (Upper Triassic) – Orange and purple mudstone, siltstone, and sandstone with 1- to 3-foot- (0.5-1 m) thick interbeds of mottled dusky-red to pale-yellowish-green limestone, representing highly bioturbated paleosols with abundant rhizoliths and large burrows (up to 2 inches [5 cm] diameter). Member commonly covered by talus deposits of the overlying Wingate and Kayenta sandstones. 150-200 feet (45-60 m) thick.

$\overline{T}$rcp **Petrified Forest Member of the Chinle Formation** (Upper Triassic) – Moderate-reddish-brown mudstones and siltstones interbedded with carbonate nodule horizons 2 feet (0.6 m) thick, interpreted to be paleosols. Basal portion contains a locally continuous, dark-reddish-brown, ledge-forming, medium- to coarse-grained sandstone called the "Capitol Reef Bed." Contains petrified wood. Most of the member forms a slope with local small ledges. 110-135 feet (35-40 m) thick.

$\overline{T}$rcm **Monitor Butte Member of the Chinle Formation** (Upper Triassic) – Light-olive-gray to greenish-gray bentonitic claystone with thin dusky-brown to dark-yellowish-orange, medium- to coarse-grained, cross-bedded, channelized sandstone beds. Forms a slope with small ledges. Contact with overlying Petrified Forest Member is poorly defined and approximated in this map. 120-150 feet (35-45 m) thick.

$\overline{T}$rcs **Shinarump Conglomerate Member of the Chinle Formation** (Upper Triassic) – Grayish-orange to very-pale-orange, medium- to very coarse grained, cross-bedded sandstone and conglomerate. Contains petrified wood. Shinarump beds are discontinuous and commonly channelized due to fluvial depositional history. The basal unconformity is scoured with 0-5 feet (0-1.5 m) of relief and is typically overlain by a gravel lag. The unconformity is regionally continuous and is found even where no Shinarump accumulation is present. The member contains uranium that has been historically mined within the quadrangle. Forms ledges and cliffs. 0-30 feet (0-9 m) thick.

$\overline{T}$rmm **Moody Canyon Member of the Moenkopi Formation** (Lower Triassic) – Moderate-reddish-brown to moderate-reddish-orange laminated mudstone and siltstone with sparse, very fine grained, ripple-laminated sandstone beds. Small-scale soft-sediment deformation common in silt and sandstone beds. Bedding-parallel gypsum veins and stringers common throughout. Typically forms a slope but locally cliff-forming where overlain by the Shinarump Conglomerate. 220-280 feet (65-85 m) thick.

$\overline{T}$rmt **Torrey Member of the Moenkopi Formation** (Lower Triassic) – Moderate-reddish-brown to moderate-reddish-orange mudstone, siltstone and very fine grained sandstone. Contains "ripple-rock" and reptilian trackways. Bedding thickness ranges from 1-15 feet (0.5-5 m). Forms ledges and slopes. 190-210 feet (60-65 m) thick.

$\overline{T}$rms **Sinbad Limestone Member of the Moenkopi Formation** (Lower Triassic) – Very-pale-orange to grayish-orange limestone and dolostone with interbeds of calcareous siltstone and sandstone, and algal boundstone. Upper beds commonly contain oolitic grains and bivalve fragments. Forms a cliff above the Black Dragon Member. 50-90 feet (15-25 m) thick.

$\overline{T}$rmb **Black Dragon Member of the Moenkopi Formation** (Lower Triassic) – Moderate-reddish-brown to moderate-reddish-orange interbedded mudstone, siltstone, and sandstone with gypsum stringers throughout. Forms slopes. In many areas undercuts, and is commonly covered by talus composed of, the overlying Sinbad Limestone. 80-120 feet (25-35 m) thick.

PERMIAN ROCKS

Pk **Kaibab Limestone** (Lower Permian) – Upper 100 feet (30 m) is composed of very-light-gray to yellowish-gray shale and limestone beds with carbonate and silicate nodules. Lower portion is composed of interbedded pale-gray limestone and calcareous sandstone beds. Locally sandstone beds contain glauconite grains. Lower Kaibab interfingers with Cutler Group, creating a gradational contact. Contact is drawn at the base of the lowest limestone bed. Forms slopes and ledges. 400-500 feet (120-150 m) thick.

Pc **Cutler Group undivided** (Lower Permian) – Very-pale-orange to yellowish-gray, fine- to medium-grained, trough cross-bebbed sandstone. Distinguished from the overlying Kaibab Limestone by the absence of carbonate beds. Undivided in this locality due to the absence of the Organ Rock Shale between the White Rim Sandstone and Cedar Mesa Sandstone. Base not exposed within the quadrangle. Forms ledgy cliffs. Greater than 1000 feet (300+ m) thick.

Pu **Paleozoic and Precambrian rocks undifferentiated.** (Cross-section)

MAP SYMBOLS

- Contact
- Fault - bar and ball on the downthrown block; dashed where approximate, dotted where covered: arrow indicates oblique slip
- On cross-section indicates lateral movement towards the reader
- On cross-section indicates lateral movement away from the reader
- 6000 — Structural Contours - drawn on the top of the Cutler Group; units are feet above sea level; contour interval: 200 feet; dashed where projected above ground surface
- Anticline - showing anticlinal axis; arrow shows direction of plunge
- Syncline - showing synclinal axis; arrow shows direction of plunge
- A ——— A' Line of cross section
- 10 Strike and dip of bedding
- Joints - showing trend of prominent joint sets
- Joints - showing location of major near-vertical joints in the Glen Canyon Group

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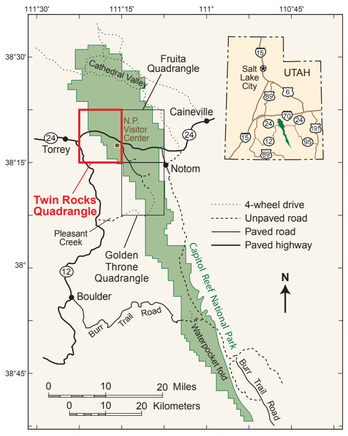
DISCLAIMER

LITHOLOGIC COLUMN

SYSTEM	FORMATION	MEMBER	THICKNESS feet (meters)	MAP SYMBOL	LITHOLOGY	ENVIRONMENT
JURASSIC	Carmel Formation, Paria River Member		150-200 (45-60)	Jcpr		marine
	Page Sandstone		130-150 (40-45)	Jpc		eolian
	Glen Canyon Group: Navajo Sandstone	upper member	450-550 (135-170)	Jn		eolian
		basal member	110-150 (35-45)	Jno		eolian
	Kayenta Formation		200-300 (60-90)	Jk		fluvial
	Wingate Sandstone		260-310 (80-95)	J$\overline{T}$rw		eolian
TRIASSIC	Chinle Formation	Owl Rock Member	150-200 (45-60)	$\overline{T}$rco		lacustrine/ fluvial
		Petrified Forest Mbr.	110-135 (35-40)	$\overline{T}$rcp		
		Monitor Butte Mbr.	120-150 (35-45)	$\overline{T}$rcm		
		Shinarump Cgl. Mbr.	0-30 (0-9)	$\overline{T}$rcs		
	Moenkopi Formation	Moody Canyon Member	220-280 (65-85)	$\overline{T}$rmm		coastal plain & tidal flat
		Torrey Member	190-210 (60-65)	$\overline{T}$rmt		
		Sinbad Ls. Mbr.	50-90 (15-25)	$\overline{T}$rms		marine
		Black Dragon Mbr.	80-120 (25-35)	$\overline{T}$rmb		
PERMIAN	Kaibab Limestone		400-500 (120-150)	Pk		marine
	Cutler Group undivided		1000+ (300+)	Pc		eolian



Location of Twin Rocks quadrangle in Capitol Reef National Park.

ROADS AND TRAILS

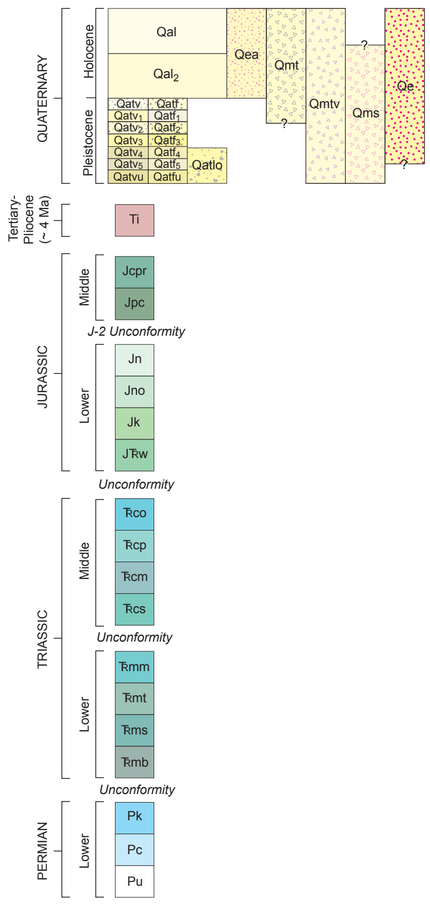
Paved road

Gravel and dirt road

Trail

Key access roads, selected trails, and prominent features in and near Capitol Reef National Park shown in brown. Condition and status of roads and trails may change over time. Some not shown. From data provided by National Park Service.

CORRELATION OF MAP UNITS



Looking northwest into the Twin Rocks quadrangle along a strike valley eroded into the upper members of the Moenkopi Formation. Beds dip north-northeast off of Miners Mountain anticline west of the photo. The sandstone "wall" on the right makes up part of "Capitol Reef." Early trappers and pioneers called any long barrier to travel a "reef." Thousand Lake Mountain forms the dark highlands in the background.

The great wall or escarpment north of Highway 24 is carved into the Jurassic-Triassic Wingate Sandstone. Photo by Grant Willis.

Chimney Rock consists of a resistant sandstone cap of the Shinarump Member of the Chinle Formation sitting unconformably on the Moody Canyon Member of the Moenkopi Formation. The Monitor Butte Member of the Chinle Formation forms the upper slope.

Twin Rocks are formed of coarse sandstone of the Shinarump Member of the Chinle Formation and rest on the Moody Canyon Member of the Moenkopi Formation. The Wingate Sandstone forms the cliff in upper right. Photo by Grant Willis.